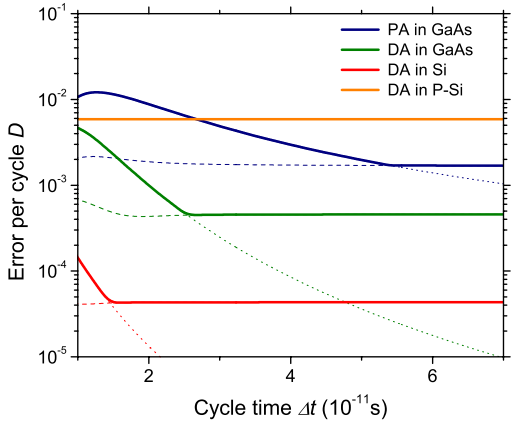
ITR/SY: Center for Modeling of Quantum Dynamics, Relaxation and Decoherence in Solid-State Physics for Information-Technology Applications

Vladimir Privman, Clarkson University, DMR-0121146

The main **objective** of our program has been the exploration of *coherent quantum mechanical processes* in novel solid-state semiconductor information processing devices, with components of atomic dimensions: **quantum computers**, **spintronic devices**, and **nanometer-scale computer logic gates**.

The **achievements** to date include new modeling tools for evaluating initial decoherence and transport associated with quantum measurement, spin polarization control, and quantum computer design, in semiconductor device structures.

Our **program** has involved an interdisciplinary team, from Physics and Electrical Engineering to Computer Science and Mathematics, with extensive collaborations with leading experimental groups and with Los Alamos National Laboratory.



Design and calculation of the reliability of nanometer-size computer components utilizing technology based on transport through quantum dots.

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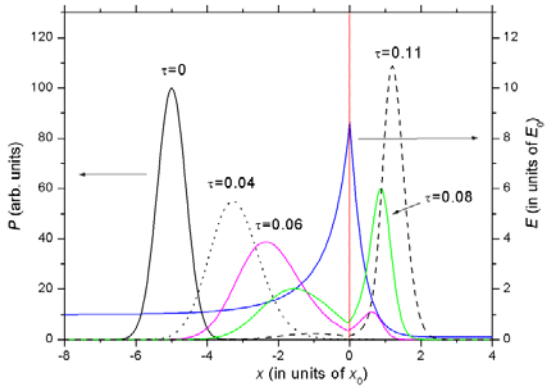
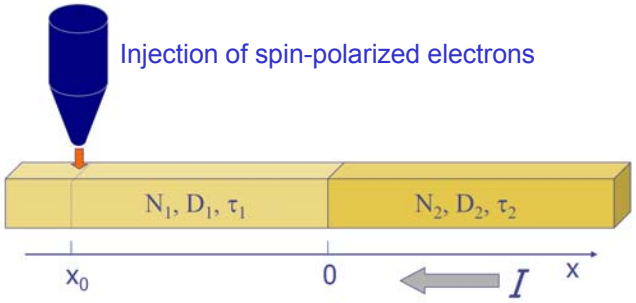
The **educational impact** includes training 11 undergraduate students, 9 graduate students, 4 postdoctoral researchers, and the development of two new courses to introduce quantum nanotechnology concepts to undergraduate and graduate students.

Our **outreach program** has included sponsoring conference events, an international *Quantum Device Technology* workshop series, and numerous lectures and presentations.

Our results to date are **published** in 47 articles, including 4 prestigious Physical Review Letters.

Applications for **national security** (information security and national leadership in advanced technology) have resulted in funding of our program by the National Security Agency, via the US Army Research Office.





Control and accumulation of spin coherence in semiconductor nano-devices, at interfaces between differently doped regions.